Chapter V - SAMPLING AND CONTROL OF ASPHALT CONCRETE

SECTION 501 GENERAL

(Reference Secs. 211 and 315, *Road and Bridge Specifications*.) See Sec. 206 for Independent Assurance sampling requirements. See Sec. 207 for useage of asphalt concrete under modified acceptance procedures.

The production of high quality asphalt concrete mixtures, requires that the product meets definite specifications. These specifications are not arbitrary figures, but are the result of years of experience, data analysis and research. It shall be the duty of the Producer's Certified Asphalt Plant Technician to see that all component materials have been approved for use, and that they are combined into a mixture that meets all specification requirements.

The advantage of an asphalt concrete mixture that meets the specifications is in low cost maintenance. Thus, with the Producer's Certified Asphalt Plant Technician rests the initial responsibility of obtaining a mixture meeting the specification requirements and ensuring the best possible construction at a minimum cost to the State.

VDOT employs a quality management program to ensure that quality asphalt concrete mixtures are produced and placed throughout the State. This program is a system of quality control (QC) testing, quality assurance (QA) testing, and Independent Assurance (IA) testing. The QC testing is performed by the Contractor; both QA and IA testing are performed by the Department.

For asphalt concrete (a.k.a. - hot mix asphalt [HMA]), the quality management program is divided into two areas – production and placement. For production, VDOT performs a system-wide approach to monitoring the mixture. Instead of retrieving material from the plant for a specific project, HMA mixture is sampled on a regular basis at the plant. This sampling procedure lets VDOT perform both IA and QA testing on the material. This process, described in more detail in Section 502, ensures VDOT is meeting the requirements of 23 Code of Federal Regulations 637.

In contrast, HMA placed in the field is tested on a project basis as the second part of the quality management program. While the Contractor is required to perform acceptance testing for density per VTM-76 on all projects, the level of QA and IA testing performed by the Department varies by project type. The QA/IA testing procedures are found in Section 503. Table 1 outlines the field density testing requirements.

Quality Element	Project Type			
	Federal Aid – NHS System	Federal Aid – Non- NHS	State Funded Construction	State Funded Maintenance
Quality Control	R	R	R	R
Quality Assurance	R	D	D	D
Independent Assurance	R	D	D	D

R – Required
D – Desired

Table 1 – Quality Management Program (HMA Placement)

Sec. 501.01 General Responsibility of Materials Division

(a) Personnel Certification (see Section 115 of Manual of Instructions)

The Department will provide classroom technical instruction, examination, and certification for all appropriate personnel. The State Materials Engineer shall direct the administering of examinations and certifications for Technicians and Inspectors.

Written examinations shall be administered by the District Materials Engineers for certification of Department and Industry personnel in their respective Districts. The written examination shall be monitored by the District Materials Engineer or his/her assistant, and an accurate accounting of all examination papers shall be maintained.

All written examinations shall be prepared, graded, and recorded under the direction of the State Materials Engineer.

Reexamination and recertification will be required within 5 years of the calendar year in which the certificates are issued. The status of the certification for Inspector and Technician is valid only for the specific responsibilities and privileges granted to the bearer and name appearing on the certificate issued. If at any time an Inspector or Technician is found incapable of performing his or her duties as prescribed herein, he or she shall not be allowed to take part in the production or placement of asphalt concrete being manufactured for State use. The certification issued shall be rendered invalid on the recommendation of the District Materials Engineer.

(b) Quality Assurance Testing

Quality assurance (QA) testing consists of "All those planned and systematic actions necessary to provide confidence that the Contractor's quality control sampling and testing results used in the acceptance decision are accurate, unbiased and will satisfy the Department's requirements for quality"(see Section 206 for a more detailed definition of QA). Simply put, QA testing should determine if the material passes or fails. The Department will provide quality assurance testing at the plant and in the field. Testing will be performed by the Central Office Materials Division and/or the District Materials Section. The District Materials Engineer will designate the individual(s) responsible for executing the QA program within their district. The designated individual(s) shall be certified in the areas of their responsibility (i.e. Asphalt Plant and/or Asphalt Field Certification).

(c) Independent Assurance Testing

Independent Assurance (IA) testing is defined as "Activities that are an unbiased and an independent evaluation of all Operations, sampling and testing procedures, and equipment used in the acceptance program"(see Section 206 for a more detailed definition of IA). The Department will provide independent assurance testing at the plant and in the field. Testing will be performed by the Central Office Materials Division and/or the District Materials Section. The District Materials Engineer will designate the individual(s) responsible for executing the IA program within their district. The designated individual(s) shall be certified in the areas of their responsibility (i.e. Asphalt Plant and/or Asphalt Field Certification).

Sec. 501.02 Duties of the Project Inspector

(a) Initial Duties of Inspector

The following instructions cover the sampling, testing, and inspection of asphalt concrete pavements at the job site. Specific instructions are contained herein for the density, depth and temperature measurements. See Sec. 206 for Independent Assurance sampling requirements.

The Inspector shall see that the spray bars on the distributor are of such length as to give the proper priming width, and make sure that all nozzles are free of any obstructions, so that an even and complete spray will be obtained. He/she shall check the rate of distribution and make necessary computations for the rate of application to be used. The Inspector must make sure that the liquid asphalt material being used for priming or tacking has been approved by the Materials Division before it is used.

Duties in the checking of paving machines, rollers, and small tools are covered in the Construction Manual of Instructions.

The Project Inspector should take and record temperature measurements of the asphalt concrete at the beginning of paving operations and thereafter at a rate of not less than one measurement every hour. The inspector may increase the frequency of temperature measurements at any time. The temperature should be checked using an appropriate heat-sensing device (i.e. probe thermometer, infrared thermometer, etc.). It is suggested that the measurements be recorded on the delivery ticket for the load(s) measured. Additionally, the temperatures should be recorded in the project diary for a permanent record.

The Inspector should use the following procedure to measure the temperature of asphalt concrete at the job-site:

1) When using a mechanical or digital probe thermometer, it will be inserted into the asphalt concrete through an appropriate hole in the bed of the delivery truck. The thermometer should be allowed to stabilize (this may take a minute or more) and the temperature recorded. The Inspector will ensure the asphalt temperature is not less than the specified minimum laydown temperature for the mix (Section 315 in the *Road & Bridge Specifications)* nor higher than 350º F (175 º C).

2) Once the measured/recorded asphalt temperature is found to be within specifications, the Inspector will inform the delivery driver and allow the load to be emptied into the paver or Material Transfer Vehicle (MTV) hopper for use on the project.

3) If the initial temperature measurement is not within specifications, or the delivery truck bed does not have an appropriate hole in the side, the Inspector will take four (4) additional temperature measurements. The Inspector should direct the delivery driver to raise the truck bed a few feet (a meter) such that the majority of the asphalt in the load is visible, and only a minimal amount of material is dumped into the paver or MTV hopper.

    a) The Inspector will then measure and record the temperature at four (4) different locations within the bed of the truck. The center points of these measurements should be several feet apart to account for the area over which the infrared device takes its measurements (generally a 1–1.5 foot (0.3 – 0.45 m) diameter area at a distance of 10 feet (3 m)). The average of these four (4) readings will be considered the temperature of the load.

The load is accepted for use on the project if the load's temperature is not less than the minimum laydown temperature nor higher than 350º F (175º C). Additionally, not more than one of the four infrared temperature readings may be outside of specification limits for the load to be accepted for use on the project.

Note: care must be taken not to record temperatures from the asphalt material exposed to ambient air and wind during transport to the project site.

b) Once the asphalt temperature has been measured/recorded and found to be within specifications, the Inspector will inform the delivery driver that the remainder of the load may be emptied into the hopper for use on the project.

c) If an excessive amount of rejected material is dumped into the hopper, the Contractor may be instructed to remove the material prior to continuing paving operations.

Nothing, herein, regarding temperature measurement should be taken as requiring acceptance of loads of asphalt concrete that have crusts of cooler material that would remain in clumps as the material moves through the paver. If a MTV with re-mixing capability is being used, clumps of cooler material should be of lesser concern.

(b) Reports

It is the duty of the Project Inspector to fill out accurately and submit promptly all necessary reports.

See Secs. 112.01 and 502.02 for details of collecting weigh tickets, Forms TL-102A, and for documentation of delivery of tonnage material.

See Sec. 800 for details of preparing and/or handling the above noted reports and records.

SECTION 502 PLANT SAMPLING, TESTING, AND INSPECTION OF ASPHALT MIXTURES

The following instructions cover plant sampling, testing, and inspection of asphalt mixtures (concrete) prior to placing in pavements. Tests of the finished pavement for depth and density will be covered in Sec. 503. See Sec. 206 for Independent Assurance sampling requirements. See Sec. 207 for asphalt concrete that may be accepted on visual inspection.

Sec. 502.01 Plant Equipment

(a) Plant Laboratory Equipment

Plant laboratory equipment shall be the Producer's equipment. Equipment in need of repair or replacement should be reported to the Producer by the District Materials Engineer or the Engineer's representative.

Plant quality control testing laboratories shall be equipped, as outlined in Sec. 106.07 of the *Road and Bridge Specifications*. The following statement is intended to clarify the Department's position with regard to the use of a single laboratory to service more than one plant belonging to the same firm:

The Department reserves the right to require a laboratory conforming to the requirements of Sec. 106.07 at each plant which is processing material for Department use; however, use of a single laboratory to serve several plants in a given area may be permitted, provided such multiple use does not adversely affect the efficiency and timeliness of the sampling and testing program at each plant. In the event a dispute arises over the practicality of multiple plant use of a single laboratory, such disputes are to be referred to the State Materials Engineer for resolution.

It is not intended that the aforementioned policy be administered in such manner as to alter the number of samples required, the timing of the taking of samples, the required presence of a Certified Asphalt Plant Technician at each plant, delay the progress of the work, and/or waive other specific requirements relating to the sampling and testing of the material.

(b) Plant Operating Equipment

The District Materials Engineer or his/her representative shall ascertain as early as possible that the plant is equipped in accordance with specifications (in addition to the laboratory equipment noted in Paragraph (a) above), and capable of producing a mixture conforming to the requirements of the specifications. He/she shall also determine if the liners, gates, and blades of the mixer are in satisfactory condition for efficient mixing. All timers, thermometers, pyrometers, etc., necessary for the proper control of the mixtures, shall be in satisfactory working condition. He/she shall make sure that all scales and batch test weights are calibrated, certified, and sealed, and that a bonded weighperson is available, as outlined in Sec. 106.04 herein.

Sec. 502.02 Inspection of Plant, Equipment, and Personnel

(a) Initial Plant Inspection

The plant will be inspected before production for compliance with specification requirements governing plants and testing equipment. A program of regular but unannounced inspection shall be scheduled and supervised by the District Materials Engineer at all asphalt concrete plants supplying asphalt concrete for State work. This inspection shall be conducted at any plant initially setting up and starting production, and at least once per year thereafter or as required. The purpose of this inspection is to determine that the plant, equipment, and personnel meet specification requirements. A record shall be prepared on a checklist type form (see form at end of this Chapter) of all items covered during the plant inspections by the District Materials Engineer or his/her representative.

(b) Regular or Routine Plant Inspection

The plant will be inspected periodically during production, including items such as stockpiles, equipment, weighing operations, sampling, testing, and records kept by the Contractor's Technician. These inspections will be in addition to the initial or annual inspections noted in Paragraph (a) above, will likewise be completely unannounced, and shall be conducted by personnel of the District Materials Engineer's staff and/or by Central Office Materials personnel. The inspections are to be conducted for the purpose of determining whether or not specifications and instructions are being followed by Contractor and personnel in the production, sampling, testing, and inspection of asphalt concrete.

The frequency of these latter plant inspections should be related to the overall quality of the plant equipment and competence of the plant personnel. Plants that have a record of continually producing good materials, of being in excellent condition, and manned by well trained personnel might be inspected as seldom as once per year. However, plants with poor records should be inspected more often. Periodic inspection of all plants at the same frequency regardless of record is not recommended.

A plant inspection report is to be issued on the forms available for this purpose immediately upon completion of this inspection. The forms (see sample at the end of this chapter) are to be completely and accurately filled out by the District or Central Office Materials personnel conducting the inspection, noting any and all discrepancies and any corrective action taken by the producer's personnel during the inspection. In addition to copies of the report retained for District use, a copy of plant inspection reports shall be forwarded to the State Materials Engineer.

Unfamiliar Department and Industry personnel shall be requested to show evidence of their certification to visiting representatives of the Materials Division.

(c) Maintaining Records

Materials personnel shall keep a diary of plant visits, observations, and comments made to the Contractor's representative.

Sec. 502.03 Materials

It is the responsibility of the Producer's Certified Asphalt Plant Technician to see that all materials are properly handled to prevent them from becoming unsuitable for use. Stockpiles of aggregates shall be made carefully so that a minimum amount of segregation of the aggregate occurs, and that there is no contamination from foreign materials. For mixtures composed of a blend of two or more aggregate sources , proportioning of the aggregates shall be done by means of divided cold feeder bins equipped with positive action gates that can be securely locked.

Heating and storage tanks for asphalt cement shall be kept in good condition and properly protected to prevent contamination from dust, debris, or water.

Frequent checks must be made during plant operations to determine that the temperature of aggregates, liquid asphalt and asphalt mixtures are within the limits of the specifications and are reasonably constant.

If it becomes necessary during the course of highway work for a plant to change sources of asphalt cement, the following suggested guidelines should be adopted. Of utmost importance is the need for Suppliers of asphalt cement to furnish Contractors/Producers a viscosity-temperature chart that reflects the characteristics of the specific cement being used, so that the mix can be effectively fine tuned.

Both the Industry and the Department should plan ahead for possible changes in the source of asphalt cement, and changes should only be made where necessary to maintain productivity. The Producer should make every reasonable effort to draw down the storage tank to approximately 6 (150 mm) above the heating elements, before introducing a new source of material. The Producer should then use the applicable job-mix formula and viscosity-temperature charts for the new material.

Unless obvious problems with a mix develop when an asphalt source is changed, it will not be necessary to submit a new mix design. However, only one source of each ingredient (asphalt cement, aggregates, and additives, etc.) will be permitted to be shown on a given job-mix formula, Form TL-127 (see Section 803.61 herein). When the only change in a job-mix formula is a different source of asphalt cement, it is not necessary to change the job-mix I.D. in the computer; therefore, an individual lot of material may have different sources of cement. If problems are experienced in mixing or rolling the mixture, the Producer should adjust the mix temperature, based on the viscosity of the asphalt cement used.

Asphalt cement sources should be identified on Form TL-100A (see Section 803.47) using the source codes supplied by the Department. The codes will appear on the computerized test report but the name of the source will not appear due to limited space for such information.

In summary, indiscriminate and frequent changes in the source of asphalt cement could contribute to quality control problems and should be avoided if possible. Unless the change in the material source is planned, such change precludes the effective use of viscosity-temperature charts in fine tuning the mix.

Sec. 502.04 APPROVAL OF JOB-MIX

Approval of new and rollover mix designs (mix designs approved in a calendar year other than the current one) for asphalt mixtures shall be in accordance with the procedures designated herein. This is a three-step process: Part A is an initial approval of mix design paperwork; Part B is the testing, analysis and approval of production mix; and Part C is the recordation of average values from at least the last two full lots produced during a calendar year. Under this system rollover mix designs are handled in a similar manner but with some of the testing required under Part A waived.

(a) Mix Design Approval (Part A)

(1) Initial SUPERPAVE® Designs

Prior to initial production the asphalt producer must complete a full mix design in accordance with VDOT test methods and procedures. All paperwork and documentation for the mix design shall be submitted to the District Materials Division for review and Part A approval. The Department has a maximum of 10 business days to review and approve or return with recommendations for pre-paving season mix design submittals. It is recognized that it is in the best interest of both the Contractor and VDOT to review and approve mix designs during the paving season as quickly as possible, therefore the Department has a maximum of 3 business days to review and approve or return with recommendations mix designs during this time with most being accomplished with 24 hours.

This shall include:

- Mix Design Volumetric Data
- Materials and Mix Gradations
- Permeability Testing (where required)
- Job Mix Formula (JMF)
- Aggregate Properties
- Furnace Correction Factor
- Field Correction Factor ($G_{se} - G_{sb}$)

Upon review of the mix design paperwork, aggregate properties, Furnace Correction Factor, etc. for compliance with VDOT specifications the mix shall be approved for Part A. The authorizing signature and date are indicated on the Part A approval. This approval authorizes the producer to attempt to produce the mix design on limited production for Part B approval. Part B approval is required before full mix design production will be permitted.

Note: TSR test data is not required to be submitted under Part A.

(2) Rollover Superpave Designs

Mixes that had Part B approval the prior calendar year shall receive Part A approval for the new calendar year provided:

- Aggregate Properties are furnished for the current year
- Furnace Calibration is submitted for the current year
- Field Correction Factor ($G_{se} - G_{sb}$) is submitted for the current year

(3) Initial SMA Designs

Prior to initial production the asphalt producer must complete a full mix design in accordance with VDOT test methods and procedures. All paperwork and documentation for the mix design shall be submitted to the District Materials Division for review and Part A approval. The Department has a maximum of 10 business days to review and approve or return with recommendations for pre-paving season mix design submittals. It is recognized that it is in the best interest of both the Contractor and VDOT to review and approve mix designs during the paving season as quickly as possible, therefore the Department has a maximum of 3 business days to review and approve or return with recommendations mix designs during this time with most being accomplished with 24 hours.

This shall include:

- Mix Design Volumetric Data
- Materials and Mix Gradations
- Job Mix Formula (JMF)
- Aggregate Properties
- Furnace Correction Factor
- Field Correction Factor ($G_{se} - G_{sb}$)
- VCA Dry Rodded Condition, G_{ca} and VCA_{mix} values
- F & E aggregate test data

Approval of Part A for SMA mixes is authorization to construct a trial section.

(4) Rollover SMA Designs

Mixes that had Part B approval the prior calendar year shall receive Part A approval for the new calendar year provided:

- Aggregate Properties including F&E, VCA_{drc} and G_{ca} are furnished for the current year (prior to production)
- Furnace Calibration is submitted for the current year (prior to production)
- Field Correction Factor ($G_{se} - G_{sb}$) is submitted for the current year.

(b) Validation of Production Mix Design and General Production Approval (Part B)

Prior to going into full mix production the asphalt producer must obtain Part B of VDOT's Mix Design approval process by demonstrating that the production mix meets VDOT mix design requirements.

(1) Initial SUPERPAVE® Designs

The asphalt producer has the option of:

1. Going on a limited production of 500 Tons (500 metric tons) for the first day's production of this initial analysis or,

2. Obtaining prior approval of the mix design during non-VDOT system mix production. If prior approval is obtained the first day's limited production requirement is waived.

Field gyratory samples shall be taken from either the limited production or prior production and analyzed, by both the Department and by the Producer, for compliance with specification requirements and mix design/JMF.

For Limited Production the Department will have a maximum of 24 hours from the time test results are received from the Contractor to review and approve or make corrective action recommendations. It is recognized that it is in the best interest of both the Contractor and VDOT to review and approve mix designs during the paving season as quickly as possible.

For non-VDOT mix production the Department will have a maximum of 5 business days from the time the sample is taken to review and approve or make corrective action recommendations.

The Producer shall provide the District Materials Division with 24 hour prior notice, whenever possible, before beginning Limited Production. Otherwise it may not be possible for the Department to meet the 24-hour turn around period. The Department shall however give priority to all Part B Limited Production Samples.

If the production mix meets VDOT specifications, approved Part A mix design, and JMF requirements, then the mix receives Part B approval, which constitutes authorization to go into full production.

In addition, the asphalt producer shall:

- Resolve all discrepancies between production mix gradation, asphalt content, or other properties and the approved Part A initial mix design and/or JMF within the first 3 lots of produced mix.
- TSR testing of production mix will be run and data furnished the Department within the first 3 lots.
- Furnish aggregate properties and Furnace Calibration for production mix within first 3 lots.

The resulting JMF shall then be used to establish the Acceptance criteria for all Lots.

Limited Production or off-site mix production for Part B approval that do not meet specifications shall not receive Part B approval and full production authorization. Failing TSR requirements, non-submittal of required data within the allotted time are all grounds for suspension or denial of Part B mix design approval.

(2) Rollover Superpave Designs

The limited production/ off-site mix design approval requirement is waived for rollover mix designs provided Part C from the previous year met specifications and complied with approved mix design and JMF. Mixes failing to meet this requirement must go through the same Part B approval process as for a new mix design.

In addition, the asphalt producer shall:

- Resolve all discrepancies between production mix gradation, asphalt content, or other properties and the approved Part A initial mix design, JMF or Part C from the previous year within the first 3 lots of produced mix.

- TSR testing of production mix will be run and data furnished the Department within the first 3 lots.

Aggregate properties and Furnace Calibration shall be furnished for production mix within first 3 lots.

(3) Initial SMA Designs

Prior to going into full SMA mix production the asphalt producer must obtain Part B of VDOT's Mix Design approval process by demonstrating that the production mix meets VDOT mix design requirements. Because of the challenges associated with the design, production, placement and compaction of SMA, a trial section is required for SMA at a location identified in the contract. Both mix design requirements and in-place density compliance are evaluated as part of the trail section approval process. The Department will have a maximum of 24 hours from the time test results are received from the Contractor to review and approve or make corrective action recommendations. It is recognized that it is in the best interest of both the Contractor and VDOT to review and approve mix designs during the paving season as quickly as possible.

The Producer shall provide the District Materials Division with 24 hour prior notice, whenever possible, before beginning a trial section. Otherwise it may not be possible for the Department to meet the 24-hour turn around period. The Department shall however give priority to all Part B trial section samples.

Approval of the trial section by the Department constitutes Part B approval and is authorization for unrestricted mix production.

In addition, the asphalt producer shall:

- Resolve all discrepancies between production: mix gradation, asphalt content, or other properties and the approved Part A initial mix design, JMF or Part C from the previous year within the first 3 lots of produced mix.
- TSR testing of production mix will be run and data furnished the Department within the first 3 lots.
- Aggregate properties and Furnace Calibration shall be furnished for production mix within first 3 lots.

The resulting JMF shall then be used to for Acceptance criteria on all Lots

(4) SMA Rollover Mix Design Approval

The SMA trial section requirement is waived for rollover SMA mix designs provided Part C from the previous year met specifications requirements, complied with approved mix design and JMF, and met density requirements. Mixes that do not meet these requirements must go through the same trial section/Part B approval process as for a new mix design.

In addition, the asphalt producer shall:

- Resolve all discrepancies between production: mix gradation, ,asphalt content or other properties and the approved Part A initial mix design, JMF or Part C from the previous year within the first 3 lots of produced mix.
- TSR testing of production mix will be run and data furnished the Department within the first 3 lots.

- Aggregate properties and Furnace Calibration shall be furnished for production mix within first 3 lots.

(c) Closeout Lots (Part C)

At the end of the calendar year the averages from at least the last two full lots of mix shall be recorded and dated under Part C of Mix Design Approval. This shall include the gradation, asphalt content, Rice value, and mix volumetrics. This data will be comprised of Contractor test results.

Sec. 502.05 Documentation of Tonnage Material

For details of documentation of tonnage material and the bonded weigh program, see Secs. 108.04 and 800 herein.

Sec. 502.06 Sampling Asphalt Mixtures

Sampling of asphalt mixtures shall be in accordance with the procedures designated herein. Three types of sampling and testing are performed at the plant – QC, QA and IA. QC sampling and testing is performed by the producer at the plant. QA/IA sampling and testing are performed by the Department.

(a) Producer Samples and Tests (QC)

Quality control samples are those obtained by the Producer's Certified Asphalt Plant Technician at the plant and tested in the Plant Laboratory. These tests are grouped into two areas – Acceptance Tests and Process Control Tests. Please see Section 206 for definitions of Acceptance Tests and Process Control Tests.

(1) Acceptance Tests (AT)

Grading and Asphalt Content

A statistically acceptable method of randomization is to be used to determine the time for taking the stratified random sample. See the Asphalt Concrete Plant Certification Study Guide for an approved randomization method. See VTM-48 for method of obtaining sample. The frequency of sampling shall be at a rate of 4 samples per 2000 ton (2000 metric tons) lot (4000 ton (4000 metric tons) lot may be used when the normal production exceeds 2000 tons (2000 metric tons) per day). The samples shall be obtained from the approximate center of truckloads of material. Grading and asphalt content will be determined using the Ignition Method, as outlined in VTM-102. The sample size should not be less than 10 lbs. (5 kg) Reflux Extraction shall not be used except in cases where the equipment used in the Ignition Method experiences breakdown. In those cases, written approval from the District Materials Engineer shall be obtained prior to use of Reflux Extraction. The written approval will establish the time frame in which the Reflux method can be utilized. During this time frame, the Department will use the Ignition Method for determining asphalt content.

Temperature Measurements

The Producer is to make initial temperature measurements on the first and fifth loads of each type mix of each production day, after which at least one measurement should be made every hour (approximately) of production time for each mix type. Measurements made at the time of quality control sampling will suffice for one of the one hour measurements. If, when measuring the temperature of an asphalt mixture, it is found to be outside of the temperature tolerances, a minimum of 3 additional measurements will be taken from different points of

the load. The 4 readings will then be averaged and used as the temperature of the load or batch. All temperature measurements and the average shall be recorded.

(2) Processs Control Tests

Volumetric SUPERPAVE® Tests

For Volumeteric SUPERPAVE® tests, it will be necessary to sample mixtures of asphalt concrete types as indicated in the *Road and Bridge Specifications* Section 211. The frequency of sampling shall be at a rate of one sample per day per mix or per 1,000 tons (1000 metric tons) per mix if more than 1,000 tons (1000 metric tons) of a mix is produced per day. If less than 300 tons (300 metric tons) of a mix are produced in a day, then SUPERPAVE® testing is not required. However, once the accumulated tonnage for a mix exceeds 300 tons (300 metric tons), then the minimum testing frequency shall apply. The sample shall be taken from several locations in the truck load of completed mix and combined to form a representative sample. The sample size should not be less than 25 lbs. (12.5 kg)

Rice Testing shall be performed per AASHTO T-209.

Determination of Particle Coating Test

Tests for the determination of particle coating (determination of mixing time or Ross Count Tests) will be performed by the Contractor and approved by the Engineer, in accordance with AASHTO T195, as specified in Sec. 211 of the *Road and Bridge Specifications*.

(b) Department Samples and Tests – QA and IA

Quality Assurance (QA) and Independent Assurance (IA) samples are those obtained at the asphalt concrete plant by the Producer's Certified Asphalt Plant Technician in the presence and under the observation of the Department's representative, and tested in the Department's District or Central Office Laboratory, at the Department's discretion.

During production, two types of samples are retrieved from the plant by the Department on a generally (not necessarily statistically valid) random basis. One sample is used to determine the AC content and gradation of the mixture for acceptance. These samples are used for system-wide IA and QA purposes. A second sample is used to evaluate the process control testing of the Contractor on the volumetrics of the mixture. Currently, this sample is used for QA purposes only as described in the *Road and Bridge Specifications*.

(1) IA on Contractor Acceptance Tests

AC Content and Gradation

In general, during the first production week of a roll-over mix in a new calendar year, it is desired that 4 IA samples be retrieved from the plant in a generally random manner. Thereafter, a minimum of 2 IA samples per production week will be taken for production. A "production week" is defined as a total of 5 production days. For new mixes, an IA sample should be retrieved on the first day's limited production per Section 502.04(b)(1). After the initial day's limited production and approval by the Department, three (3) additional IA samples will be retrieved during the first production week. As with the roll-over mixes, a minimum of 2 IA samples per production week will be taken after the first production week. Whatever the production tonnage may be, each IA test (after the first production week) should represent at least 500 tons (500 metric tons) of material. When the same job mix

formula is used for more than one mix type (for example – IM-19.0A and SM-19.0A), it shall be considered as one material.

This rate of IA sampling is mandatory, and it is the responsibility of the District Materials Engineer to see that it is accomplished. Should the monitoring effort fall behind the required frequency of sampling and/or testing, the District Administrator is to be advised immediately. Sufficient personnel are to be provided for the monitoring effort.

The Department will observe the manner in which sampling is performed by the Contractor. (See VTM-48.) Not only is the "when", "where", and "how" of taking the sample important, but also the care taken to properly reduce the sample to testing size. The Department's representative directs when the sample shall be taken. He/she shall observe the Contractor's Technician taking and splitting (quartering) the sample. The Department's representative takes one half of the sample to serve as the independent assurance (IA) sample. The Contractor's Technician will perform the tests on the other half, which shall be considered as the next quality control sample for the Contractor. The sample size shall be such that, when properly halved, each sample should be not less than 10 lbs. (5 kg)

Comparison of Test Results

An Individual comparison should be made between the Contractor's and VDOT's test results on the IA split sample. Listed in Table 2 are the maximum Acceptable Range of Two Test results called the D2S Percent. This is the Individual Test Percent differences between 2 results obtained on test portions of the same material. These values were taken directly from AASHTO T30 and T308 Precision and Bias Statements and should assist in making the comparison of quality control and IA test results.

Parameter	Total Percent of Material Passing	Standard Deviation	Acceptable Range of Two results (D2S) Percent
All Sieve Sizes	≤100 ≥95	0..94	2.2
	<95 ≥40	1.70	4.7
	<40 ≥25	1.36	3.8
	<25 ≥10	0.75	2.1
	<10 ≥5	0.56	1.6
	<5 ≥2	0.43	1.2
	<2 ≥0	0.32	0.9
Asphalt Content		0.20	0.56

Table 2 – Maximum Allowable Differences Between Producer and QA/IA Test Results

If the percent difference between 2 results of an individual test is greater than the above percentages for individual tests (refer to VTM 59 on how to calculate D2S percent), then the sampling and testing procedures and laboratory test equipment (both the Producer's and the Department's) should be checked. If differences still cannot be explained, then the

Department may call for the referee system to determine final disposition of the material. If it becomes necessary to implement the referee system, refer to Sec. 211.10 of the *Road and Bridge Specifications* to determine the size of sawed section samples to be taken from the roadway pavement.

Weekly statistical comparisons will be made between the quality control grading and asphalt content test results and those of the Department's IA sample. The frequency of these comparisons may be adjusted by the District Materials Engineer when no significant quantity of new IA results are available. This comparison is made by the District Materials Engineer or representative, using the the Matched Comparison Report (IA) available from the Materials Division's Asphalt Database. This matched comparison report (IA) compares all the IA and Producer's QC samples taken to date. The matched comparison report is generated from the IA and QC data using the method outlined in VTM-59. The comparison report will flag those values that are outside the statistically accepted range for samples taken from the same production operation. The District Materials Engineer or representative should investigate the cause of each flag and report the results of the investigation to the State Materials Engineer at the end of the production year for use in preparing the annual report to the FHWA.

Quality assurance assessment of asphalt plant produced material is not performed by taking separate samples, but is an interpretation of the data from the IA samples and Quality Control tests. This interpretation is to be performed on a weekly basis within the asphalt database program once 4 IA samples are obtained. A comparison is made by the District Materials Engineer or representative, using the the Non-Matched Comparison Report (QA) available from the Materials Division's Asphalt Database. This non-matched comparison report (QA) compares all the IA and the non-matching Producer samples taken to date. This non-matched comparison report is generated using the method outlined in VTM-59. This comparison report will flag those values that are outside the statistically accepted range for samples taken from the same production operation. The District Materials Engineer or representative should investigate the cause of each flag. When flags occur in which the data generated from the Departments' non-matched IA samples gives an indication that the material may not be within specification limits while the Contractor's sample data indicates compliance with specifications a thorough investigation must be conducted. The DME should report the results of these investigations to the State Materials Engineer at the end of the production year

AC Temperature Measurement at the Plant

The District Materials Engineer or his/her representative will perform IA for temperature measurements by verifing the acceptance testing of temperature through witnessing /observation. This can be accomplished at start up on the first or fifth truckload, during an hourly temperature check by the producer or at the time an IA sample is taken from a truckload.

(2) QA on Contractor Process Control Tests

Volumetric SUPERPAVE® Tests

For Volumetric SUPERPAVE® tests, it will be necessary to sample mixtures of asphalt concrete types indicated in the *Road and Bridge Specifications*. A Department representative shall obtain one sample from the first 1,000 tons (1,000 metric tons) of mix produced per job-mix formula, and one sample for each additional 10,000 tons (10,000 metric tons) produced using the same job-mix formula. The first sample should be submitted to the District or Central Laboratory no later than the second day's run of the job-mix formula. The sample

shall be taken from the plant. The sample shall be taken from several locations in the truck load of completed mix and combined to form a representative sample. The size of the sample should be not less than 25 lbs. (12.5 kg)

Rice Testing shall be per AASHTO T-209

All samples shall be packed and marked, in accordance with Sec. 203, using Form TL-10 (see Section 803.03 herein) or a similar form approved by the laboratory conducting the tests, as outlined in Sec. 800. The Materials Division representative should indicate on Form TL-10 that the sample is specifically for determination of volumetric properties using Superpave gyratory compaction test procedures.

Abson Recovery Tests

Samples for the determination of the quality of the asphalt by the Abson Recovery Test shall be taken from the completed mixture at the plant by a Department representative and submitted to the Central Office Laboratory for analysis, in accordance with AASHTO T170. The purpose of this sample is to determine the properties of the asphalt after the production of the asphalt concrete. The samples shall be obtained from several locations in the truck and combined to form a representative sample. The size of the sample should be not less than 10 lbs. (5 kg) The shovel used to obtain the sample should be free of fuel oil or other materials which may affect the properties of the asphalt.

A minimum of one sample per plant per 100,000 tons (100,000 metric tons) per construction season shall be taken. This sample may be taken anytime between April 1st and October 1st without regard to the type of mix. Where RAP (Reclaimed Asphalt Pavement) material is used, a minimum of one sample should be taken for the mix design formula with the greatest percentage of RAP per plant/per mix type. (i.e. SM-12.5A, BM-25.0D, IM-19.0A) If it can be accomplished safely, an asphalt tank sample should be taken to be used to compare to the asphalt recovered from the mix. This sample may be used to satisfy sample requirements in Section 204.05.

In the event the test results are questionable, additional samples shall be taken from the pavement on the projects or schedules where the asphalt concrete was placed. The samples shall be packed and marked, in accordance with Sec. 203, using Form TL-10, as outlined in Sec. 800, and sent to the Central Office Laboratory for test. The test will be reported on Form TL-50 (see Section 803.34), as outlined in Sec. 800.

Sec. 502.07 Material Acceptance

VDOT will accept the product in accordance with the specifications, based upon the Producer's test results, provided such results are statistically comparable (VTM-59) to the Department's test results and provided the material passes a visual examination for contamination and segregation at the job site. The sole purpose of the IA sample taken by the Department is to verify the accuracy of the Producer's testing program.

Sec. 502.08 Duties of Department's Representative

During the time of the Department representative's visit to the plant, he/she will pickup the Producer's test results and the District Materials Engineer's copy of the daily summary sheets, Form TL-102A. The forms are reviewed for correctness and legibility. The contract numbers(s) and tonnage(s) are obtained from the weigh sheets and recorded on the input form, Form TL-100A (see Section 803.47), which is input into the Asphalt Database.

The original and one copy of the test report, Point Adjustment Analysis Report for each lot, will be generated from the database. The report should be reviewed for correctness. The original should be put in the District Materials Engineer's project folder with the corresponding TL-102A (see Section 803.50) sheets. The other copy should be forwarded to the Contractor/Producer that is producing the material. If there is more than one contract on the lot, only one lot copy is to be sent. One copy of the lot should also be put in a plant file. This is the only distribution that is needed. The materials notebook only requires a one line entry identifying the period of time over which the material was shipped (Fr._____ To_____), grading or type mix, total tonnage, and source.

In case of nonconformance to the specifications, a copy of the test report will be furnished to the Prime Contractor.

(a) IA Test Review

The results of the IA tests are taken from the laboratory reports and entered into the Asphalt Database. Once the IA results and the corresponding QC lot test results have been entered into the database, then the production and IA comparisons for each plant can be executed within the Asphalt Database. Before executing the comparison reports, make sure that at least 4 IA results have been entered. Also, if there is a change in the JMF, begin with the lot number after the date of the change. A report comparing the production results with the IA results will be generated (i.e. the Matched Comparison Report (IA)). When the report is processed, review it for correctness and send one copy to the Contractor/Producer by way of the Department Representative. If the results are not in agreement (flagged), an investigation should be made to determine the reason for differences. Suggested checks are:

(1) Check the individual records to see if all the data has been entered correctly.

(2) Check the individual Producer's result versus the IA test to see if the 2 results are comparable (See Table 2).

(3) Check to see if one of the systems is indicating a trend (consistently fine, coarse, erratic, etc.)

(4) Check sample splitting and testing procedures.

(5) Check testing equipment.

(b) QA Test Review

QA test review is not performed by taking separate samples, but is an interpretation of the data from the IA samples and Quality Control tests. A comparison is made within the database comparing all the IA and the non-matching split QC samples taken to date. This is the Non-Matched Comparison (QA) report. The District Materials Engineer or representative should review it for correctness. If the results are not in agreement (flagged), an investigation should be made to determine the reason for differences. Suggested checks are:

(1) Check the IA report to see if the same items are flagged

(2) Check the time and tonnage of when QC and IA samples were taken to ensure random sampling. QC /IA samples should not be retrieved from the same tonnage on a systematic basis. A review of the distribution of samples by tonnage ranges may indicate if a sampling bias is present.

(3) Check to see if the IA test results indicate that the material probably meets the specifications and that the Standard Deviation of the test results is within the range for which the specifications would not impose a price reduction.

Sec. 502.09 Responsibility of Asphalt Concrete Producer

(a) Materials

The Asphalt Concrete Producer shall assume responsibility for the quality control and condition of all materials used in asphalt concrete, as well as the handling, blending, and mixing operations, in accordance with Sec. 211 of the *Road and Bridge Specifications*. The Producer shall assume responsibility for the initial determination and all necessary subsequent adjustments in proportioning of materials used to produce a specified asphalt concrete mixture. Any time during plant operation, after initial setup, that sample failure occurs, adjustments will be made to bring the mixture within specifications again. If these adjustments do not correct the failure, the plant shall be stopped and recalibrated.

(b) Personnel

All sources supplying asphalt concrete to the Department shall be required to have present during the initial setup, for all subsequent adjustments of the plant, and at all times during production, for each job-mix, a Certified Asphalt Mix Design Technician, as outlined in Sec. 211.05 of the *Road and Bridge Specifications*. Such Technician shall be capable of designing, sampling, testing, and adjusting the mixture. (See Sec. 207.02 herein for details of waiver of this requirement.)

(c) Equipment

The Producer shall be responsible for providing and maintaining a plant laboratory and testing equipment, as outlined in Sec. 106.07 of the *Road and Bridge Specifications*. The Producer will be required to build a platform from which to take samples from the truck bodies.

(d) Performance of Sampling, Testing, and Recording by Asphalt Concrete Producer

Quality control samples are to be taken and tests performed by the Certified Asphalt Plant Technician, as outlined in Secs. 502.06 (a)(1) (Grading, Asphalt Content, and Temperature.) It will also be the Producer's responsibility to perform the process control sampling and testing specified in Secs. 502.06 (a)(2) (SUPERPAVE® Design and Ross Count Tests).

The Producer shall be responsible for recording test results and maintaining quality control charts. The Producer shall furnish the Department's representative copies of the test results on forms (see TL-100A, section 803.47) furnished by the Department and maintain current control charts at the plant for review by the Department. The tests results are to be available for pickup by the Department withing 48 hours of the completion of each lot. Failure to furnish the results in a timely manner may be considered justification for suspension of job-mix approvals. The Producer shall likewise maintain all records and test results associated with materials used in the production of the asphalt concrete; e.g., asphalt cement, etc.

(e) Notification of Production

The Producer shall notify the District Materials Engineer when production is to start or resume after a delay.

(f) Assisting the Department's Representative

The Producer shall obtain a sample at the request of the Department's representative and analyze a split portion of the sample. The Department will analyze the other split portion. This sample shall be used as the next quality control sample. See Sec. 502.06(b) for additional details of performing this sampling operation.

(g) QC Reports

Reports of quality control tests conducted in the Plant Laboratory will be reported on Form TL-100A. (See Sec.502.08.) The TL-100A reports shall be provided within 48 hours of the closeout of a lot. All other tests of asphalt mixtures conducted in the District or Central Laboratories (IA and QA on process control tests) will be reported on Form TL-50A. Job-mix formulas will be documented on Form TL-127 and the database generated Form TL-127B. Documentation of tonnage material will be reported on Form TL-102A (Daily Summary Sheet), as outlined in Secs. 106.04(e) and 800 herein. See these Sections, also, for details of Weighing Inspection Reports, and Weighperson checklists and certifications.

SECTION 503 ROAD SAMPLING, TESTING, AND INSPECTION OF ASPHALT PAVEMENTS

The following instructions cover the sampling, testing, and inspection of asphalt concrete pavements at the job site. Specific instructions are contained herein for the density and depth tests.

Sec. 503.01 General

The Project Inspector will see that the Contractor follows all instructions, and will notify the Construction Manager or Area Construction Engineer if there is any misunderstanding, lack of cooperation, or any other situation that cannot be promptly corrected. The Inspector will maintain an attitude of cooperation and helpfulness with the Contractor to secure maximum production within specification limits. The Inspector should not hold up or delay operations unnecessarily, as continuous operation is essential to uniform results, as well as to economical operation. All instructions shall be issued to the Superintendent or Foreman in charge of the work.

Sec. 503.02 Density Acceptance Testing (Contractor)

The density testing method to be used for asphalt concrete pavement will be one of the following:

1. The thin lift nuclear method outlined in VTM-76 and Special Provisions or Specifications for Sec. 315.05 *Road and Bridge Specifications*. Only designated scratch courses do not require density testing.
2. Plugs/Cores obtained as outlined in VTM-22 and AASHTO T166. The latter method may be used in cases of breakdown of the nuclear gauge, when directed in lieu of the thin lift nuclear method, or where the nuclear method is not appropriate.

The method to be used will be as specified in the *Road and Bridge Specifications* or Special Provisions, or as directed by the Engineer. It should be emphasized that the frequencies given for testing are the minimums considered desirable to provide effective control of materials under ideal conditions, and more testing than that specified should be done if deemed necessary by the Engineer.

(a) Thin Lift Nuclear Method

(1) General

See Secs. 105.02 through 105.04 for details and safety precautions for the use of nuclear equipment. The thin lift nuclear method shall be conducted in accordance with VTM-76 and Special Provisions or Specifications for Sec. 315 of the *Road and Bridge Specifications*. The thin lift gauge shall be furnished and operated by the Contractor.

Thin lift density testing will be conducted using the Control Strip Method of testing as outlined in VTM-76. Under this procedure, the density reading obtained in the test section is compared with the corresponding control strip density. The quality assurance density testing will be accomplished as outlined in Sec. 503.03 Quality Assurance Density Testing. The method for IA will be performed as outlined in Section 503.04 Independent Assurance Density Observations.

A roller pattern and control strip density must be established for each layer or lift placed, in order to establish the target density required before testing of test sections.

(2) Frequency of Tests

For thin lift nuclear density testing, the reported density will normally be the average of 10 individual density readings representing a lot of asphalt pavement approximately 5,000 linear feet (1500 m) in length for each lift and pass of the paver. Two of the ten readings will be randomly selected from each 1,000 (300 m) linear foot sublot. See Section 315 of the *Road and Bridge Specifications* for the handling of partial length lots and the evaluation of sublots. The reported density will be considered the density of the entire length and width of the roadway represented by that lot. Payment for the tonnage of asphalt mixture contained in the lot will be in accordance with the density payment schedule in Section 315 of the *Road and Bridge Specifications*.

If there is a breakdown in the nuclear testing equipment, then density tests should be continued using other methods, (sawed plugs or cores) as approved by the Engineer.

(b) Plugs/Cores

(1) General

With cores and plugs, the percent compaction of the completed asphalt concrete pavement is determined by dividing the actual bulk specific gravity of the pavement samples by the theoretical maximum specific gravity of a completely voidless mixture composed of the same materials in like proportions. The actual bulk specific gravity shall be determined, as outlined in AASHTO T166 and modified by VTM-6. The maximum specific gravity shall be determined, as outlined in VTM-22, together with AASHTO T209, if desired.

(2) Frequency of Tests

Sampling for density determination on the mainline will be at the rate of no less than one per 1,000 feet (300 m) paver pass. Crossovers and connections will not be sampled for density; however, the tonnage contained therein will be included in the lot. The lot size will be 5,000 linear feet (1500 m) and will be determined by the quantity of asphalt concrete furnished by each plant for the contract item. Tests will be performed in accordance with VTM-22.

(3) Obtaining the Test Specimens

The test specimens shall be obtained as follows:

(1) Test specimens shall be cut from the pavement with a portable saw or other approved method. If water is used as a cooling agent, then the contractor must have an approved method to dry the core/plug.

(2) The length of the sides of the sawed specimens shall not be less than 3 in. (75 mm) nor more than 4.5 in. (113 mm) [4 in. (100 mm) diameter cores may be used]. The thickness of the specimens shall not be less than 1.0 in. (25 mm)

(3) Mark out squares of pavement as indicated in sketch below.

(4) Cool marked area with gas (CO_2) or dry ice.

(5) Cut out specimens using the approved method. (It will be necessary to cut out past the marked lines, so that a full-depth cut is obtained.

(6) Recool marked area with gas sufficiently to pry out specimens without distorting.

(7) Pry out Square 1 by applying pressure to either side and discard. Pry out Squares 2 and 3 to use as test samples. (Do not distort.)

1	2	3

(8) Carefully remove saw tailings and clean any loose material from surface of specimens. When placing specimens in basket to weigh in water, take care not to entrap air under the specimen. (Again, do not distort specimens.)

(9) Determination of bulk specific gravity will be in accordance with VTM-6; maximum specific gravity will be determined in accordance with AASHTO T209; and percent compaction will be determined in accordance with VTM-22.

(c) Computation of Pay Factor

Price adjustment factors will be applied to the quantity of material in accordance with Sec. 315 of the *Road and Bridge Specifications*.

(d) Reports

Results of job acceptance nuclear density tests in the field shall be reported on Forms TL-56, TL-57, TL-58.TL-59 and TL-60 Results of density tests by other methods shall be reported on forms approved by the District Materials Engineer's representative. Reports are to be submitted to the Engineer at the completion of each roadway segment.

All test reports must be completely filled out, giving all required information. All tests, both passing and failing, must be reported. See Sec. 800 for additional details of completing and distributing these forms.

Sec. 503.03 Density Quality Assurance Testing (Department)

Testing will be performed on surface, intermediate and base mixes that have been evaluated by the Contractor. Density QA testing will be performed by either obtaining 4" (100 mm) diameter cores or 4"x 4" (100 mm x 100 mm) plugs according to VTM-6 and VTM-22 or using an

independent (Department owned) nuclear gauge conforming to the requirements of VTM 81. Density QA testing will be performed by or under the direction of a District Materials representative. If nuclear gauge verification is used, then the Materials Representative must be present during the establishment of the roller pattern and control strip or a new control strip must be run in their presence. Density QA testing is to be performed on Federal-Aid projects on the NHS and should also be performed on as many non-NHS and state funded projects as practicable.

(a) QA by Nuclear Density Gauge

(1) Procedure for QA Density Testing Using a Nuclear Gauge.

District Materials personnel will randomly select locations for QA Density tests by a randomization procedure similar to the randomization procedure shown in VTM-32, Depth Test of Bituminous Concrete Base Course. The QA Density tests to be conducted will be performed by the Materials representative. The Materials representative will establish a target density by taking 10 readings on the same control strip density site that the Contractor has marked and used to establish the target density (VTM 76).

Perform QA Density testing with the nuclear gauge by obtaining ten (10) stratified random nuclear density readings for a test section of roadway. The test section is defined as 5,000 linear feet)(1500 m) of paved lane width with subsections of 1,000 linear feet (300 m). The QA test section limits should coincide with the QC lot limits for comparison purposes.

The average of these ten nuclear density readings (two per subsection) will be compared to the target nuclear control strip density established by the Materials representative. Once the comparison is performed, the following steps shall be followed:

Step 1) If the test section meets the full payment criteria for density (98% to 102% of the Materials representatives' target nuclear control strip density), then continue obtaining ten random nuclear density readings on 20% of the total paved lane length until completion of the project. The random sites for QA density testing should be independent of Contractor's random acceptance testing density sites. The QA density readings will be recorded in lbs./ft^3 (kg/m^3). and the percent compaction calculated to the nearest 0.1 percent.

Step 2) If the test section does not meet the full payment criteria, then the Materials representative will compare their percent pay results to the Contractor's percent pay results. If the percent pay results match the Contractor's results or if the Department's average density (average percent compaction) is within 1% of the Contractor's average density (average percent compaction), then the Department's and Contractor's results are deemed equivalent. The Contractor's results will be used for acceptance purposes (full payment or penalty). If the percent pay results do not match and the average density is not within 1% of the Contractor's results, then the Materials representative with their nuclear gauge will read the ten random acceptance sites tested by the Contractor. These ten readings will be averaged with the ten original density readings; the overall average will be compared to the target nuclear control strip density for acceptance and payment. In the event the average density does not meet the full payment criteria, the limits of the failing material should be determined by testing the QC lot prior to and after the QA test section, if accessible (See Step 4 for procedure). If the overall average meets the full payment criteria, continue obtaining ten random nuclear density readings on 20% of the total paved lane length until completion of the project. The Engineer should make an assessment to determine if the average (of 20) density readings are biased.

Step 3) In the event a dispute arises over the average (of 20) density readings on this test section failing the density testing comparison criteria, then five (5) plugs/cores will be taken from the five sites closest to the average density determined from the twenty nuclear density sites. If the average density of these five plugs meets the Density testing criteria (98% to 102% of the average density of the plugs from the control strip), then an investigation will be undertaken to determine the difference between the nuclear density readings and the five cores. Part of the investigation should include comparison of the nuclear density readings obtained by the Department and the Contractor.

Step 4) If the average density of these five plugs/cores and/or the average nuclear density readings do not meet the density testing criteria, then the QC lot preceding and the QC lot after must be evaluated by repeating steps 1 and 2 until the boundaries of the failing lots have been established. The QA nuclear density testing should only be performed on the preceding QC lots that were placed on the same day. Preceding QC lots placed on previous days should be evaluated using plugs/cores. Each failing lot should be documented. The District Materials Engineer shall determine the extent to which preceding QC lots not placed on the same day are tested.

(b) Timing of QA Density Testing Using a Nuclear Gauge

The QA density testing must be completed prior to traffic being placed on the section being evaluated but during or after the Contractor has completed all his acceptance density testing for any lot as defined by specification.

(c) Frequency for QA Density Testing Using a Nuclear Gauge

The QA density tests for base, intermediate and surface mixes per project will be conducted on a paver width 5,000 linear foot (1500 m) long test section of roadway. The minimum tonnage of a mix type to warrant QA density testing shall be 500. Mix types are based on the maximum nominal aggregate size (i.e. 4.75, 9.5, 12.5, 19.0 and 25.0) and not the binder used in the mix. The minimum number of Quality Assurance density test sections required for a given project or contract will be at least 20% of the paved lane length (one test section for every 25,000 lane feet (7500 m) of paving). A minimum of one QA density test section must be tested on each project that requires QA density testing. See Table 3 for the frequency of testing.

Total Paved Lane Length ft (m)	Approx. QC Lots	Approximate QC Readings	Minimum QA Test Sections (min. 20% of Total Paved Lane Length)	Minimum IA Observations (min. 10% of QC Readings)
5,000 (1500)	1	10	1	4
10,000 (3000)	2	20	1	4
15,000 (4500)	3	30	1	4
20,000 (6000)	4	40	1	4
25,000 (7500)	5	50	1	5
30,000 (9000)	6	60	2	6

Total Paved Lane Length ft (m)	Approx. QC Lots	Approximate QC Readings	Minimum QA Test Sections (min. 20% of Total Paved Lane Length)	Minimum IA Observations (min. 10% of QC Readings)
50,000 (15,000)	10	100	2	10
55,000 (16,500)	11	110	3	11
75,000(22,500)	15	150	3	15
80,000 (24,000)	16	160	4	16
100,000 (30,000)	20	200	4	20

Table 3 – Frequency of QC/QA Testing and IA Observations

(d) Recording/Reporting for QA Density Testing Using a Nuclear Gauge

The QA densities will be recorded on forms TL-140A (see Sections 803.70).

(2) QA Density Testing Using Plugs/Cores

(a) Procedure for QA Density Testing Using Plugs/Cores

District Materials personnel will randomly select locations for QA Density tests by a randomization procedure similar to the randomization procedure shown in VTM-32, Depth Test of Bituminous Concrete Base Course. QA Density tests obtained by plugs/cores will be sampled and tested under the direction of the Materials Division according to VTM 6 and VTM 22.

Perform QA Density testing by obtaining plugs/cores from five (5) stratified random sites in a test section on the roadway. The test section is defined as 5,000 linear feet (1500 m) of paved lane width with subsections of 1,000 linear feet (300 m). When practical, the QA test section limits should coincide with the QC lot limits for comparison purposes.

Determine the in place density for each individual plug/core at each selected location using VTM 6 and VTM 22. The average density of these plugs/cores from five individual sites will be compared to the average of the plugs taken from the control strip used to establish the target nuclear density for that mix. Once the comparison is performed, the following steps shalled be followed:

Step 1) If the test section meets the full payment criteria for density (98% to 102% of the average of the plugs taken from the control strip density), then continue obtaining five stratified random plugs/cores on 20% of the test sections until completion of the project. The QA densities will be expressed in % and will be reported to the nearest 0.1 %.

Step 2) In the event a dispute arises over the average density of the five plugs/cores failing the density testing comparison criteria, then additional plugs/cores at the discretion of the District Materials Engineer may be taken from five (5) new stratified random sites in that QC lot. The average density of these ten plugs/cores will then be compared to the Density testing comparison criteria. If this average density meets the comparison requirement, then the QC lot is acceptable. Continue obtaining five

stratified random plugs/cores on 20% of the test sections until completion of the project.

Step 3) If the average density in a QC lot fails the Density testing comparison criteria, then the QC lot preceding (if accessible) and the QC lot after must be evaluated by repeating steps 1 until the boundaries of the failing QC lots have been established. Each failing QC lot will be documented.

(b) Timing of QA Density Testing Using Plugs/Cores

The QA density testing must be completed prior to traffic being placed on the section being evaluated but during or after the Contractor has completed all his acceptance density testing for that lot.

(c) Frequency for QA Density Testing Using Plugs/Cores

The QA density tests for base, intermediate and surface mixes per project will be conducted on a paver width 5,000 linear foot (1500 m) long test section of roadway. The minimum tonnage of a mix type to warrant QA density testing shall be 500. Mix types are based on the maximum nominal aggregate size (i.e. 4.75, 9.5, 12.5, 19.0 and 25.0) and not the binder used in the mix. The minimum number of Quality Assurance density test sections required for a given project or contract will be at least 20% of the paved lane length (one test section for every 25,000 lane feet (7500 m) of paving). See Table 3 for the frequency of testing.

(d) Recording/Reporting for QA Density Testing Using Plugs/Cores

QA densities will be recorded on form TL-140B (see Sections 803.70).

Sec. 503.04 Independent Assurance Density Observation (Department)

IA density observations will be performed on surface, intermediate and base mixes which are evaluated by the Contractor. IA will be performed by District Materials personnel. IA is to be performed on Federal-Aid projects on the NHS and should also be performed on as many non-NHS and state funded projects as practicable. The minimum tonnage of a mix type to warrant IA density observations testing shall be 500.

(a) Procedure

District Materials personnel will verify the Contractor's method of random determination of production reading locations and will verify QC processes by witnessing/observation. The Contractor is required to mark the location and orientation of the gauge at each test location. The Contractor may be required to supply a list of the randomly selected production test locations. The department representative will initial beside the QC readings observed on the Contractors TL-59 (see Section 803.44) form. (Please note, a QC reading is defined as a nuclear gauge test at a single location.) Additionally, the department representative will verify the nuclear gauge calibration date and serial number, and will initial beside this information on the TL-59 form.

(b) Timing of Monitor Testing

The IA must be completed while the Contractor is performing acceptance density (QC) testing.

(c) Frequency

The number of IA observations required for a given project or schedule will be at least ten percent of the number of quality control readings performed by the Contractor. The minimum number of IA observations will be four per project.

(d) Recording/Reporting

The IA density observations by the District Materials personnel will be documented on the Contractors' TL-59 Report form by being initialed by the observer beside the QC density reading results. The District Materials personnel will also record in their diary the number and date of IA density reading observations. A completed IA test report (TL-141A/B see Section 803.71) will be provided to the District Materials Engineer for review.

Sec. 503.05 Independent Assurance of Department Personnel (Department)

IA of Department QA personnel will be performed on an annual basis. IA will consist of visual observation of QA density testing or verbal examination. Upon completion of IA, a note will be placed in the personnel files maintained by the District Materials Engineer. Additionally, QA personnel will be required to obtain and maintain the proper Materials Division certifications.

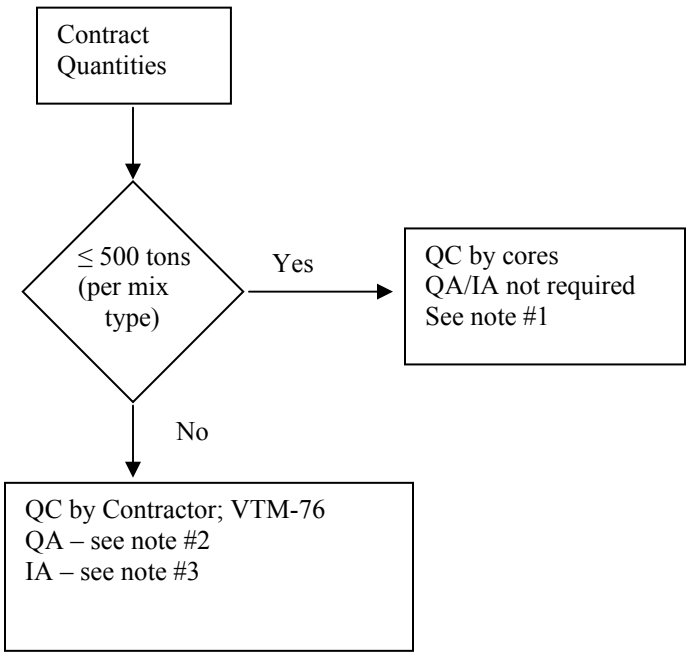
Sec. 503.06 Determination of QA/IA Requirements (Example)

VTM-76 is followed in constructing Roller Patterns and Control Strips for all asphalt mix layers. The flowchart shown is to be applied to each mix type (i.e. SM-9.0, SM-9.5, SM-12.5, SM-19.0, IM-19.0 and BM-25.0) as described in Section 503.03(c) and Section 503.04 in a contract or maintenance plant-mix schedule to determine the level of QA testing and IA observations.

Note #1:
QA/IA testing is not required for any mix type with 500 tons (500 metric tons) or less of that mix on the contract. Contractor QC testing is required for the roller pattern, control strip (see VTM-76) and for all test sections. Projects of this size are typically complete once the roller pattern/control strip is finished, or they may have a single short test section. [See *Road and Bridge Specifications* section 315.05(e)1 for exceptions to following VTM-76.]

Note #2:
QA testing is required. One (1) QA test section is needed for every five (5) QC test sections. A test is comprised of 10 nuclear gauge readings or 5 VDOT cores over 5,000 lane feet (1500 m). That is, one QA for every 25,000 lane feet (7500 m).

Note #3: IA testing is required. One (1) IA observation is needed for every ten (10) QC nuclear gauge readings AND a minimum of 4 per project.



(a) Example to Determine QA Tests and IA Regulations:

Given: A contract has the following combination of asphalt types and quantities:

SM-9.5A	300 ton (300 metric tons)	BM-25.0A	300 ton (300 metric tons)
SM-9.5D	150 ton (150 metric tons)	BM-25.0D	1000 ton (1000 metric tons)
IM-19.0A	750 ton (750 metric tons)		

Find: How many QA and IA tests are required to satisfy VDOT's Quality management program?

Solution: For each mix type, the total quantities are: SM = 450 tons (450 metric tons), IM = 750 tons (750 metric tons), and BM = 1300 tons (1300 metric tons). These are the quantities to use with the flowchart.

NOTE: The amount of QA and IA testing shown in this example is the ***minimum*** required for a Federal aid project on the NHS.

Surface Mix: The total quantity of all surface mixes on the project is 450 tons (450 metric tons). This quantity is less than 500 tons (500 metric tons) so QC testing by the Contractor is done with cores. The density of the cores is compared to the theoretical maximum density of the mix (see VTM-22 for the procedure). If the average density of the cores meets the requirements of Table III-3 in Section 315.05 of the *Road & Bridge Specifications*, then the pavement's density is deemed acceptable. QA/IA density testing will not be required if the cores are verified by testing in the Department's laboratory before determining acceptance. Possession of the **Cores must be maintained until project completion or until verified by the Department for Federal Aid Projects on NHS routes**.

IM Mix: The total quantity of all IM mixes on the project is 750 tons (750 metric tons). This quantity is greater than 500 tons (500 metric tons) so QA and IA testing is required. QC testing for this project would likely consist of the roller pattern/control strip (VTM-76), and one test section of 10 stratified nuclear test locations.

One full QA test section (10 nuclear gauge readings or 5 cores) is required [see Table 3]. If the nuclear gauge is used, then the QA technician should be present for the control strip. The QA technician determines the control strip target density using form TL-58. The technician then tests 10 different stratified random locations in the test section – separate from the QC – to see if the test section density meets specification (form TL-59). If QA testing is performed by coring, then 5 stratified random locations are cored; the density is determined following VTM-22. The average density of the cores are compared to the requirements of Table III-3 in Section 315.05 of the *Road & Bridge Specifications* to determine if the test section density meets specification.

The *minimum* number of IA observations on this project is four [10% of 10 QC tests = 1 IA, but the minimum number per project is 4]. The IA technician simply needs to observe and verify at least four of the QC technician's density readings on form TL-59. The IA technician does this by initialing the TL-59 form beside the readings they observed. The IA technician also must verify the nuclear gauge calibration date and initial this on the TL-59 form.

BM mix: The total quantity of base mix on the project is 1300 tons (1300 metric tons). This quantity is greater than 500 tons (500 metric tons) so both QA and IA testing are required.

Case 1a – Assume all the base mix is placed in a single 4″ (100 mm) thick lift and covers approximately 4400 lane feet (lf) (1340 m). The Contractor tests the roller pattern, the control strip (see VTM-76), and a test section of about 3900 lf (1200 m). Contractor QC testing consists of 2 nuclear readings in each of the 4 sublots of the test section for a total of 8 readings.

One full QA test is needed for the 'short' test section. The QA technician determines the target nuclear density from the control strip and uses that value in determining if the test section meets specification. Eight nuclear gauge readings are needed for QA testing. If QA testing will be done with cores, then four cores are required.

IA test requirements are met when the IA technician observes and verifies 4 of the Contractor's QC density readings and initials those readings on the TL-59. Four (4) IA observations are needed since that is the minimum for any project. The IA technician also verifies the calibration date of the Contractor's nuclear gauge and initials the TL-59 form beside the calibration date.

Case 1b – Assume the BM is placed in 2 - 4″ (50 – 100 mm) lifts. The first lift is placed on the aggregate base and the second is placed on top of the first BM lift. Separate roller patterns and control strips are required for each lift since the surface upon which the base mix is placed is different for each lift.

For each lift, QC testing consists of the roller pattern /control strip testing, and a single test section of about 1700 lf. (500 m) QC testing of the test section consists of 4 stratified random nuclear test readings in the 1700 ft. (500 m) (test section (2 readings in the first 1000 ft. (300 m) sublot plus 2 readings in the last 700 ft. (200 m)).

QA testing needs to be done for only one of the two BM lifts. Each lift constitutes a lot of material and the minimum testing requirement is 20% of the lots. QA testing of one of the lifts consists of determining the target nuclear density by taking readings in the control strip followed by 4 readings in the test section. If QA testing will be done with cores, then two cores are required.

IA testing for this project is satisfied with the IA technician observing and verifying 4 QC density readings in the test section. Four (4) IA observations are needed since that is the minimum for any project. The 4 IA observations can be taken on either the first or second lift or split between the lifts. For example, one IA can be done on the 1st lift and three on the 2nd lift. The technician initials those readings on the TL-59 forms.

Example Summary – QA/IA testing is not required on the surface mix due to the limited quantity. For the intermediate and base mixes, QA/IA testing is required.

Sec. 503.07 Depth Control (Department)

(a) General

Job acceptance depth tests are to be made by a person other than project personnel. This person shall be an impartial party, namely the District Materials Engineer's representative.

Measurements are to be taken periodically for each course after completion of the course depth as the work progresses. This should not be construed as requiring that the entire project be completed before conducting depth tests. Depth tests should be made as sections of the project

are completed. It shall be the responsibility of the Inspector or Construction Manager to notify the District Materials Engineer when any part of the construction is ready for depth tests.

(b) Frequency of Depth Tests

For the purpose of determining depth, and to define areas of deficient or excessive depth, the asphalt concrete base course will be sampled, as outlined in VTM-32B. (Tests of asphalt concrete binder and surface courses are required only if specific plan depths are specified, not when plans specify a rate of application.)

The project shall be divided into lots, with each lot stratified, and the location of each test within the stratified section determined randomly. A lot of material is defined as the quantity being tested for acceptance, except that the maximum lot size will be one mile of 24 ft. width base course. The randomization procedure used will be at the discretion of the Engineer. (See VTM-32B for example.) Samples will be taken from the lot at the following rate:

Lot Size	No. of Samples Required
0 - 1/2 Mile (0 – 1.0 km)	2
1/2 - 3/4 Mile (1.0 – 1.5 km)	3
3/4 - 1 Mile (1.5 – 2.0 km)	4

A separate boring will be taken from each intersection, entrance, crossover, storage lane, or ramp having an area of 500 yds^2 (500 m^2). or more. This boring will not be taken at random; however, care is to be taken not to set up a uniform pattern of testing. The tolerance for an individual test result shall apply for these miscellaneous borings.

The same frequency of testing as used on the mainline will be used for asphalt concrete shoulders requiring specific plan depths, except that the tests will be alternated from one shoulder to the other.

It is not the intent of the test procedure to prohibit sampling and testing of the material at any location which is visually determined to be out of specification tolerance for an individual test.

(c) Corrections for Areas Outside of Tolerance

If any areas are found to be outside of specification tolerances for depth, then corrections shall be made in accordance with the particular specification related to the material in question.

(d) Reports

Results of job acceptance depth tests of the above noted materials shall be retained as part of the permanent project records. The data may be kept in the form of a worksheet. Those depth tests that fail to meet specification requirements and subsequent delineation determinations shall be recorded on Form TL-105. See Sec. 800 for details of completing and distributing these forms.

SECTION 504 COLD ASPHALT MIXTURES

(a) Testing Slurry Seal

The Contractor shall submit to the District Materials Engineer a mix design, Ignition furnace calibration results, results of compatibility tests (VTM-60), and wear loss by the Wet Track Abrasion Test (VTM-14), as specified in the *Road and Bridge Specifications*.

(1) Aggregate for Slurry Seal

Aggregate shall meet the requirements specified in the contract. Samples for aggregate grading are to be taken at the rate of one test per 500 tons (500 metric tons) from designated stockpiles, in accordance with Secs. 204.02(b) and (c) herein. Although AASHTO T27 requires a washed grading test, slurry seal aggregate tests are to be performed using a dry sieve analysis.

The aggregate stockpiles must be separated at the quarry or other site and reserved for use on the schedules under contract. Once the stockpile is approved, no further testing of the aggregate will be required, unless there is visual evidence of contamination or failure to keep stockpiles properly separated.

(2) Quick Setting Emulsion

Quick setting emulsion shall meet the specification requirements of the contract. This material will be sampled and tested, as outlined in Sec. 204.05.

(3) Mineral Filler

Mineral filler shall conform to the requirements of Sec. 201 of the *Road and Bridge Specifications*. Hydrated lime will be classified as a mineral filler. Detailed requirements for sampling and testing are outlined in Sec. 204.02(b) and (c) herein.

(4) Water

Water used in the mix shall conform to the requirements of Sec. 216 of the *Road and Bridge Specifications*.

(5) Residual Asphalt Content

Residual asphalt content will be checked at a rate of one sample per 25,000 yds^2 (m^2) of slurry applied at start up. Once consistency is established the sampling rate may be decreased to one sample per 50,000 yds^2 (m^2). The sample is to be a composite of material taken after approximately one quarter of the load has been discharged and from the second one half of the load. When using VTM-36 for extraction, a minimum of 1/2 gal. (2 liters) of the completed mixture (two 4-lb. (2 kg) plastic cups) shall be submitted. Samples are to be submitted to the Central Office Laboratory, in accordance with Sec. 203, using Form TL-10, as outlined in Sec. 800.

(6) Wet Track Abrasion Check Test

Wet Track Abrasion check tests will be performed on samples of aggregate, filler, and emulsions taken from the job site. One sample per mix type per aggregate type will be taken each year. The minimum sample size shall be 15 lbs. (6.75 kg) of aggregate, one qt. (liter) of filler material, and 1/2 gal. (2 liters) of emulsion (CSS-1h or CQS-1h). Samples shall be

submitted to the Central Office Laboratory, in accordance with Sec. 203, using Form TL-10, as outlined in Sec. 800.

(b) Dense Graded Cold Mix

(1) Liquid Asphalt Material

Liquid asphalt material shall meet the requirements of the *Road and Bridge Specifications*. The material will be sampled and tested, as outlined in Sec. 204.05 herein.

(2) Aggregates

Aggregates shall meet the requirements of the *Road and Bridge Specifications*. The material will be sampled and tested, as outlined in Sec. 204.02(b) and (c) herein.

(3) Design

The design of dense graded emulsion mixes shall be in accordance with VTM-80.

(c) Surface Treatment

(1) Liquid Asphalt Material

Liquid asphalt material shall meet the requirements of the *Road and Bridge Specifications*. The material will be sampled and tested, as outlined in Sec. 204.05 herein.

(2) Aggregates

Aggregates shall meet the requirements of the *Road and Bridge Specifications*. The material will be sampled and tested, as outlined in Sec. 204.02(b) and (c) herein.

In addition, it is recommended that the Contractor sample aggregate for surface treatment periodically, and test with the Flakiness Index Test, as outlined in VTM-66. A sample of approximately 15 lbs. (7.5 kg) of aggregate will be necessary.

(3) Compatibility

Compatibility of the liquid asphalt material and aggregate will be determined in accordance with VTM-65. Tests will be performed by the Contractor and provided to the Engineer. Additional tests may be performed by the District or Central Office Laboratory, as needed. A sample of approximately 15 lbs. (7.5 kg) of aggregate and one quart of emulsion is suggested.

SECTION 505 SUMMARY OF MINIMUM ACCEPTANCE SAMPLING REQUIREMENTS

Following is a condensed tabulation showing the minimum requirements for acceptance testing of asphalt concrete. See also Secs. 205 and 206 for additional details governing minimum sampling and Independent Assurance sampling.

Table 4 - Minimum Schedule for Materials Control and Field Testing For The Construction of Surfaces(SM), Intermediate(IM), and Base (BM) Asphalt Pavement on Federal Aid-NHS Route Project Greater than 500 tons (500 metric tons) (per mix type)

Test Type	Specification	Sample Location	QC Frequency	QA Frequency	IA Frequency
In-place Pavement Density by Nuclear Method (Control Strip) (Asphalt Pavement)	Roads and Bridges Section 315.05 VTM-76 AASHTO T-166	Field	Control Strip. Establish Roller pattern according to VTM-76. Ten (10) stratified random sample to establish target density. Verify minimum density achieved with cores per VTM-76. **QC technician shall be certified and pass State proficiency**	VDOT nuclear gauge shall be used to establish QA target density on same ten stratified random samples. **QA is not required for Control Strip acceptance.** **QAtechnician shall be certified and pass State proficiency**	Materials representative observe and witness QC testing to assure gauge is calibrated and accurate.** **IA is not required for Control Strip acceptance.** **IA technician shall be certified and pass State proficiency**
In-place Pavement Density by Nuclear Method and/or VDOT cores (Test Section) (Asphalt Pavement)	Roads and Bridges Section 315.05 VTM-76 AASHTO T-166	Field	Test Section-Lot Size: 5000 ft. (1500 m) per Lane width. Ten (10) stratified random samples per lot. **QC technician shall be certified and pass State proficiency**	**QA=20%*QC Lots** Acceptance Options: 1) e.g. 25000 ft. (7500 m) per Lane width. Ten (10) stratified random samples per QA lot. Limits of QA lot should match limits of one QC lot. **QA technician shall be certified and pass State proficiency** **<u>OR</u>** 2) Coring /Saw plugs method Use AASHTO T-166 /Five (5) cores/plugs per QA lot. Preferably match to QC lot which translates to one core per 1000 ft (300 m) (QC sublot).	**IA=10%*QC** Readings Materials representative observe and witness QC testing to assure gauge is calibrated and accurate.** **IA technician shall be certified and pass State proficiency** **** Note: On rare occasions, the Materials representative may request the inspector to witness testing in the event the Materials representative is unavailable**

Test Type	Specification	Sample Location	QC Frequency	QA Frequency	IA Frequency
In-Place Depth Check for SM/IM/Base Material	Roads and Bridges Section 315.05	Mainline		Two (2) tests for 24 ft. (7 m) pavement from 0 to 1/2 mile (0 – 800m), 3 tests for pavement from 1/2 to 3/4 mile (800 – 1200 m), and 4 tests for pavement from 3/4 to one mile (1200 – 1600 m). Maximum lot size is one mile of 24 ft. (7 m) base course. Project divided into lots, each lot stratified, and location of each test with- in stratified section determined randomly.	**Not required. VDOT performs acceptance testing.**
In-Place Depth Check for Base Material	Roads and Bridges Section 315.05	Shoulders		Same as above, Base alternating sides if specific plan depths specified. Depth tests not required, if plans specify rate of application.	

Table 5 - Minimum Schedule for Materials Control and Plant Testing For The Construction of Surfaces(SM), Intermediate(IM), and Base (BM) Asphalt Pavement on Federal Aid-NHS Route Project Greater than 500 tons (500 metric tons) (per mix type)

Test Type	Specification	Sample Location	QC Frequency	IA Frequency	QA Frequency
Grading and Asphalt Content (Asphalt Pavement)	Roads and Bridges Section 211.08	Processing or mixing plant from back of truck	Four (4) - 10 lb. (4.5 kg)samples per 2000 ton (2000 metric tons) lot (4000 ton (4000 metric tons) lot may be used when normal production exceeds 2000 tons (2000 metric tons) per day). Samples to be taken in stratified random manner. **QC technician shall be certified and pass State proficiency**	In general, during the first production week of a roll-over mix in a new calendar year, it is desired that 4 IA samples be retrieved from the plant in a generally random manner with the first sample retrieved in the first 250 tons (250 metric tons) of production. Thereafter, a minimum of 2 IA samples per production week will be taken for production. A "production week" is defined as a total of 5 production days. For new mixes, an IA sample should be retrieved on the first day's limited production per Section 502.04(b)(1). After the initial day's limited production and approval by the Department, three (3) additional IA samples will be retrieved during the first production week. Whatever the production tonnage may be, each IA test should represent at least 500 tons (500 metric tons) of material. **QA technician shall be certified and pass State proficiency**	Same as IA Frequency, results from IA testing are used in QA statistical analysis.

Test Type	Specification	Sample Location	QC Frequency	IA Frequency	QA Frequency
Temperature Measurements	Roads and Bridges 211.08	QC - Processing or mixing plant from back of truck QA – Field	One temperature measurement initially on first and fifth loads, each type mix each production day, and thereafter minimum of one per hour of production time for each mix type, by Producer's Certified Asphalt Concrete Technician. If any test outside of tolerance, minimum of 3 additional tests made in different points of the load, and 4 tests averaged and average used as temperature of load or batch.	The Project Inspector should take and record temperature measurements of the asphalt concrete at the beginning of paving operations and thereafter at a rate of not less than one measurement every hour. The inspector may increase the frequency of temperature measurements at any time. The temperature should be checked using an appropriate heat-sensing device (i.e. probe thermometer, infrared thermometer, etc.).	
Abson Recovery	Roads and Bridges 211.06.	QC - Processing or mixing plant	One - 10 lb. (4.5 kg) sample per plant per 100,000 tons (100,000 metric tons) per construction season. For RAP material, a minimum of one sample for the mix design formula with the highest RAP % per plant per mix type.	One - 10 lb. (4.5 kg) sample per plant per 100,000 tons (100,000 metric tons) per construction season. For RAP material, a minimum of one sample for the mix design formula with the highest RAP % per plant per mix type.	

Test Type	Specification	Sample Location	QC Frequency	IA Frequency	QA Frequency
Field SUPERPAVE® Test	Roads and Bridges 211.08	At processing or mixing plant or from job site	One per 1000 tons (1000 metric tons) of production. A minimum of one per day if at least 300 tons (300 metric tons) produced.	One - 25 lb. (11.25 kg) sample from first 1000 tons (1000 metric tons) of mix produced per job-mix formula, and one sample for each additional 10,000 tons (10,000 metric tons) produced using same job-mix formula. First sample submitted to laboratory not later than second day's run of the job-mix formula.	
SUPERPAVE® Design	Roads and Bridges 211.03		SUPERPAVE® Designs conducted by Contractor /Producer, as specified in Road and Bridge Specifications.	SUPERPAVE® Designs conducted by Department, as specified in Road and Bridge Specifications and directed by the District Materials Engineer or Central Office Asphalt Program Engineer.	

Test Type	Specification	Sample Location	QC Frequency	IA Frequency	QA Frequency
Particle Coating Determination (Determination of Mixing Time or Ross Count Test)	Roads and Bridges 211.13	At processing or mixing plant or from job site	Test performed by Contractor/Producer and approved by Engineer, in accordance with AASHTO T195, as specified.		

Asphalt Concrete Plant Inspection Report

Producer: _____ District:_____

Date: _____ Asphalt Concrete Plant Code Number: _____

Location:_____

Plant Producing Asphalt for VDOT _____ Yes _____No _____

I. Inspection

A. Is the Contractor's Technician Certified? Yes____ No _____

B. Technician's Name: _____

C. An Approved Job Mix on file for mix being produced? Yes____ No _____

D. Is an approved random method for sampling used? Yes____ No _____

Type of random method used _____

E. Quartering method used to obtain monitor sample.

Sample Splitter_____Quartering Method _____

F. Are Control Charts being kept up to date? Yes____ No _____

G. Are all records and test results being maintained for materials produced? Yes____ No _____

II. Weighperson

A. Weighperson's Name: _____

Phone Number: _____

B. Weighperson Certified by DME? Yes _____No _____Expires _____

C. Company Bonded unto the Commonwealth of Virginia in the amount of $10,000. Yes _____No _____Expires _____

III. Aggregates

A. Are stockpiles satisfactory? Yes____ No _____

B. Are aggregates from an approved source? Yes____ No _____

C. Is recycled material being used? Yes____ No _____

D. Is moisture of completed mix 1.0% or less? Yes____ No _____

E. Are Baghouse fines being added back to the mix? Yes____ No _____

1. If yes, what percent? _____ Where in relationship to the drum are the fines being added_____

2. Are they being metered uniformly into the mix? Yes____ No _____

IV. Asphalt Release Agent

A. Brand Name: _____Foaming _____Nonfoaming

Company Name _____

Address _____

_____

B. If nonfoaming, are truck beds being raised to remove excess? Yes____ No _____

C. Is excess release agent in truck bed? Yes____ No _____

V. Anti-Stripping Additives

A. Liquid - added by AC Supplier _____; added at Plant in AC Tank _____ ; added to tank truck hauling AC____; added by dispenser at Plant_____

Brand Name: _____ Quantity Used _____

Company Name_____

Address _____

_____

B. Lime - Added in Dry Form _____ ; Added in Slurry Form _____

Percent used_____ Specification _____

Test No. or Certification _____

Company Name_____

Address _____

_____

How are lime and aggregates mixed _____

_____

Is it being mixed uniformly with aggregate before entering drier? Yes____ No _____

Is there a flow indicator or sensor interlocked with the plant controls such that production of the mixture will be interrupted if there is a stoppage of the lime feed Yes____ No _____

VI. Asphalt Concrete Mixing Plant

A. Safety Requirements

1. Are there adequate safe stairways to inspection points Yes No ____
2. Is there adequate and safe access to sampling points? Yes No ____

B. Asphalt Storage

1. Does the storage system have an adequate heating system? Yes____ No _____
2. Are pipelines jacketed or insulated to prevent undue Loss of heat? Yes____ No _____
3. Is a sampling spigot provided? Yes____ No _____

C. Feeder for Drier

1. Is there a separate feeder for each size aggregate being used? Yes____ No _____
2. Do bins have adequate separation to prevent contamination of the aggregate in adjacent bins? Yes____ No _____

D. Batch Mixer

1. Does plant have a hot bin for each size aggregate being used? Yes____ No _____

2. Does each hot bin have an overflow pipe? Yes____ No _____

3. Are the thermometric devices maintained in good working condition?

   Drier: Yes____ No _____

   Asphalt Line Yes____ No _____

4. Is plant being run by cold feed controls? Yes____ No _____

5. Date truck scales sealed _____

6. Date aggregate scales sealed _____

7. Date asphalt scales sealed _____

8. Date Independent scale checks _____

9 Are digital controls of scale reading correct batch weight for asphalt cement? Yes____ No _____

10. Is the asphalt material delivered to the mixer in a thin, uniform sheet or multiple streams for the full width of the mixer? Yes____ No _____

11. Is the temperature of the asphalt material 350°F or less at the time of introduction into the mixer? Yes____ No _____

12. Are digital controls of scale(s) reading correct batch weight for each bin? Yes____ No _____

13. Are digital controls plainly visible to the operator at all times? Yes____ No _____

14. Do the gates on the bins and weigh hoppers prevent leakage when in the closed position? Yes____ No _____

15. Does the batch mixer have a twin pugmill or other approved type? Yes____ No _____

16. Condition of pugmill mixer blades _____

    _____

17. Has Ross Count been conducted to determine mixing time? Yes____ No _____

18. Time lock on pugmill? Yes____ No _____

19. Does the plant have automated batching system? Yes____ No _____

E. Drum Mix Plant

1. Is a thermometric instrument placed at the discharge chute of the drier to register automatically or indicate the temperature of the completed mix? Yes____ No _____

2. Are aggregates proportioned by a positive weight control at the cold feed by use of a belt scale? Yes____ No _____

3. Is the cold feed automatically coupled with the bitumen flow to maintain the required proportions? Yes____ No _____

4. Are digital controls set correct? Yes____ No _____

5. Are digital controls plainly visible to the operator at all times? Yes____ No _____

F. Storage System

1. Is plant equipped with a storage system? Yes____ No _____

2. Is the system capable of conveying the mix from the plant to the storage bins and storing the mix without a loss in temperature, segregation or oxidation of the mix? Yes____ No _____

3. Is the conveyor system enclosed so that the mix temperature is maintained? Yes____ No _____

4. Type of Conveyor System? Continuous _____Skip bucket _____

5. How long is mix being stored? Less than 24 hours_
More than 24 hours

6. If mix is stored over 24 hours (not exceeding 10 days) has the heating system been approved? Yes____ No _____

7. Are the storage bins designed in such a manner as to prevent segregation of the mix during discharge from the conveyor into the bins? Yes____ No _____

8. Are the storage bins equipped with discharge gates that will not cause segregation of the mix while loading the mix in the trucks? Yes____ No _____

9. Has Ross Count been conducted on completed asphalt concrete mixture? Yes____ No _____

VI. Testing Laboratory

A. Are tests run at the Plant? Yes____ No _____

1. AASHTO T164 Method B Extraction Yes____ No _____
(If Yes fill out worksheet for check of test method)

2. Are Field Marshall's Run at Plant Yes____ No _____
(If Yes fill out worksheet for check of test method)

Remarks _____

_____

_____

_____

_____

_____
Signature of Person Conducting Inspection

_____
Signature of Asphalt Concrete Technician

VIRGINIA DEPARTMENT OF TRANSPORTATION

MATERIALS DIVISION
LABORATORY INSPECTION REPORT
ASPHALT CONCRETE

Superpave Design Lab ___ or Field Superpave Lab _____

District : _____ Date: _____

Producer: _____ Location: _____

Plant Code: _____ Lab Number: _____

Lab Supervisor: _____ Phone: _____

Inspected By: _____ Phone: _____

_____

(Signature – Lab Supervisor) (Date)

_____

(Signature – VDOT Inspector) (Date)

Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures AASHTO T 209

1. Vacuum Container:
   a. Capable of withstanding the full vacuum applied _____
   b. Equipped with required fittings and accessories _____
   c. Hose opening covered with wire mesh _____
   d. Size of container suitable for minimum size of test sample _____
   e. Type of container described in T 209 _____
2. Vacuum Pump:
   a. Capable of maintaining a residual pressure of 27.25 ±2.25mmHg _____
   b. One or more filter flasks or equivalent installed _____
   c. Residual pressure manometer or vacuum gauge connected directly to vacuum container _____
   d. [for VDOT – manometer reads within ±4 mmHg of calibrated meter If not, recommend calibration and post a note with the difference] _____
3. Adjustable Valve _____
4. Water for covering sample is 25 ±4°C (77 ± 7ºF) _____
5. Water bath suitable for immersion of the suspended container
   a. Equipped with an overflow _____
6. Balance:
   a. Sufficient capacity and sensitivity [sensitive to 0.1 g] _____
   b. Suspension apparatus and holder permits weighing the sample while suspended from the center of the scale pan of the balance _____

Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens AASHTO T 166

1. Water bath suitable for immersing the specimen in water _____
   a. Equipped with overflow outlet. _____
2. Suspension apparatus made of smallest practical size wire and suspends specimens from center of balance _____
3. The suspension apparatus is fully immersed when weighing _____
4. Towel for SSD determination _____
5. Thermometer capable of reading to nearest 0.1°C (0.2°F) _____
6. Thermometer range of 19°C – 27°C (66°F – 80°F) _____

Determination of Asphalt Content from Asphalt Paving Mixtures by the Ignition Method VTM-102

1. Capable of maintaining 650°C (1200°F) _____

2. Furnace is level _____
3. Furnace door locked during test _____
4. Proper venting provided for furnace exhaust, includes fire stop if direct vented _____
5. Two tempered stainless steel basket sets _____
6. Tongs for removing sample _____
7. Heat resistant cooling plates _____
8. Balance, at least 10kg capacity, sensitive to 1g _____
9. High temperature gloves, safety glasses & long sleeved jacket _____

Ovens

Capable of maintaining 120°C – 130°C (248°F – 266°F) _____

No.	Manufacturer	Forced Air or Conventional	Temperature Range	Thermostatically Controlled	Condition

Mechanical Analysis of Extracted Material

AASHTO T 30

Sieve size	Number Inspected: 8" or 12"	Number Good	Number Bad	Number Inspected: Gilson	Number Good	Number Bad
50.0 mm (2")						
37.5mm (1.5")						
25.0 mm (1")						
19.0 mm (¾")						
12.5 mm (½")						
9.5 mm (3/8")						
4.75 mm (#4)						
2.36 mm (#8)						
1.18 mm (#16)						
0.60mm (#25)						
0.30 mm (#50)						
0.150 mm (#100)						
0.075 mm (#200)						
Pans & covers						

Marshall Apparatus
(Optional) AASHO 245

1. Specimen molds

   4-inch: (I.D. 3.995" to 4.005") No. checked _____ No. passed _____

2. Specimen Extractor

4-inch: a. Diameter of disk ≥ 100mm (3.95”) _____

b. Thickness of disk ≥ 12.7mm (0.5”) _____

c. Uniform vertical movement (2” per minute) _____

3. Compaction Hammer

4-inch: a. Tamping face: unslanted, flat; diameter > 98.4mm (3.875”) _____
b. Sliding weight: 4527g to 4545g (9.98 lb to 10.02 lb) _____
c. Drop of 455mm to 459mm (17.94” to 18.06”) _____

4. Compaction Pedestal

a. Steel cap: 12” x 12” x 1” _____

i. Level _____

ii. Firmly attached to pedestal _____

b. Wooden Post: 18” tall, 8” to 12” square _____

i. Density of post: 42 – 48 lb/ft^3 (0.67 to 0.77 g/cm^3) _____

ii. Post is plumb _____

iii. Attached to concrete slab by 4 angle brackets _____

iv. Solid concrete slab _____

v. Specimen mold holder mounted on pedestal _____

1. Centers the specimen on center of post _____

Hot Plates

No.	Manufacturer	Heat Source	Temperature	Thermostatically Controlled	Condition

Resistance of Compacted Asphalt Mixtures To Moisture-Induced Damage AASHTO T283

1. Water Bath

a. Depth at least 6 in. (150mm) for 4-inch (100 mm) specimens _____

b. Depth at least 8 in. (225mm) for 6-inch (150 mm)specimens _____

c. Perforated false bottom or a shelf 1 in. (25mm) above the bottom _____

d. Capable of maintaining temp of 59°C to 61°C (138°F – 142°F) _____

2. Loading Device
   a. Capable of uniform movement of 2 in/min (50mm/min) _____
   b. Capacity of 5,000 lb for 4-inch (100 mm) specimens _____
   c. *OR* Capacity of 10,000 lb for 6-inch (150 mm) specimens _____

3. Freezer
   a. Maintain temp of –18 ± 3°C (0 ± 5°F) _____
4. Proper breaker bar apparatus _____
5. Plastic film, masking tape, leak-proof plastic bags _____
6. Oven and Vacuum apparatus (from VTM-102, T 209) _____

Miscellaneous

1. Mixing Apparatus
   a. Bowl or pan for hand mixing / mechanical mixer _____
   b. Capable of maintaining required mixing temperature _____
2. Thermometers
   a. Thermometers available for aggregates, bitumen, and mixes _____
   b. Range of 10°C to 204°C (50°F – 400°F) _____
   c. Sensitive to 3°C (5°F) _____
3. Balances

Manufacturer	Model	Calibration Date

4. Small Tools and Supplies
   a. Gloves / heat-resistant gloves _____
   b. Rubber gloves _____
   c. Trowels and spatulas _____
   d. Large spoon _____
   e. Flat-bottomed scoop(s) _____
   f. Bitumen heating containers _____
   g. Aggregate heating containers _____
   h. Paper towels _____
   i. Marking crayon or pens _____

Preparing & Determining the Density of HMA Specimens by Means of the Superpave Gyratory Compactor AASHTO T 312

1. SGC is from VDOT Materials Division approved list:
   a. 'Big' Pine model #AFGC 125X _____
   b. 'Baby' Pine model #AFG1A _____
   c. Troxler model #4140 or #4141 _____
   d. Pine/Brovold model #AFGB1A _____

2. Most recent calibration date _____

3. Calibration performed by (company name) _____

Mold #1
- Top inside diameter 149.9mm – 150.0mm _____
- Base Plate diameter 149.50mm – 149.75mm _____
- Min. height 250.0mm _____
- Min. thickness 7.5mm _____

Mold #2
- Top inside diameter 149.9mm – 150.0mm _____
- Base Plate diameter 149.50mm – 149.75mm _____
- Min. height 250.0mm _____
- Min. thickness 7.5mm _____

Mold #3
- Top inside diameter 149.9mm – 150.0mm _____
- Base Plate diameter 149.50mm – 149.75mm _____
- Min. height 250.0mm _____
- Min. thickness 7.5mm _____

Mold #4
- Top inside diameter 149.9mm – 150.0mm _____
- Base Plate diameter 149.50mm – 149.75mm _____
- Min. height 250.0mm _____
- Min. thickness 7.5mm _____

Mold #5
- Top inside diameter 149.9mm – 150.0mm _____
- Base Plate diameter 149.50mm – 149.75mm _____
- Min. height 250.0mm _____
- Min. thickness 7.5mm _____

Preparing & Determining the Density of HMA Specimens by Means of the Superpave Gyratory Compactor AASHTO T 312 (con't)

Mold #6
- Top inside diameter 149.9mm – 150.0mm _____
- Base Plate diameter 149.50mm – 149.75mm _____
- Min. height 250.0mm _____
- Min. thickness 7.5mm _____

Mold #7
- Top inside diameter 149.9mm – 150.0mm _____
- Base Plate diameter 149.50mm – 149.75mm _____
- Min. height 250.0mm _____
- Min. thickness 7.5mm _____

Mold #8
- Top inside diameter 149.9mm – 150.0mm _____
- Base Plate diameter 149.50mm – 149.75mm _____
- Min. height 250.0mm _____
- Min. thickness 7.5mm _____

Mold #9
- Top inside diameter 149.9mm – 150.0mm _____
- Base Plate diameter 149.50mm – 149.75mm _____
- Min. height 250.0mm _____
- Min. thickness 7.5mm _____

Mold #10
- Top inside diameter 149.9mm – 150.0mm _____
- Base Plate diameter 149.50mm – 149.75mm _____
- Min. height 250.0mm _____
- Min. thickness 7.5mm _____

Mold #11
- Top inside diameter 149.9mm – 150.0mm _____
- Base Plate diameter 149.50mm – 149.75mm _____
- Min. height 250.0mm _____
- Min. thickness 7.5mm _____

Mold #12
- Top inside diameter 149.9mm – 150.0mm _____
- Base Plate diameter 149.50mm – 149.75mm _____
- Min. height 250.0mm _____
- Min. thickness 7.5mm _____

Method of Test for Measurement of Permeability of Bituminous Paving Mixtures Using A Flexible Wall Permeameter
VTM-120

1. Vacuum container, pump, water bath, and balance as given in T 209 (RICE test). _____
2. Thermometer capable of measuring water temperature to nearest 0.1ºC (0.2º F). _____
3. Manometer as specified in T 209 (RICE test) _____
4. Graduated cylinder: - inner diameter of 31.75 ±0.5 mm (1.25 ±0.02 in.). _____
   - graduated in mm. _____
   - capacity of approx. 500 ml (17 oz.). _____
5. Graduated cylinder, 100 ml capacity (min.), with 1 ml or smaller graduations. _____
   a. Lower timing mark positioned 20 ± 1 cm (8 ± 0.5 in.) from top of specimen. _____
6. Sealing tube - a flexible latex membrane capable of confining the specimen. _____
7. Cap Assembly w/ expanding o-ring. _____
   - supports the graduated cylinder. _____
   - underside tapered at angle of 10 ± 1º. _____
8. Pedestal Plate w/ expanding o-ring _____
   - Opening with minimum diameter of 18mm (0.71 in.). _____
   - Top side of lower cap tapered at angle of 10 ± 1º. _____
9. O-rings capable of maintaining seal. _____
10. Frame and clamp assembly that is capable of expanding the o-rings. _____
11. Air pump capable of applying 103 kPa (15 psi) pressure and also vacuum. _____
    a. Pressure gauge with range of 0 – 103 kPa (0 – 15 psi) with ± 2% accuracy. _____
    b. Quick connects for vacuum and pressure lines. _____
12. Outlet Pipe – 50.8 mm (2.0 in.) long; inner diameter of 18 mm (0.71 in.). _____
    a. Flow line of outlet pipe is level with bottom of specimen _____
13. Valve positioned upstream of outlet pipe. _____
14. Spacer – perforated. Capable of supporting the specimen at least 25 mm (1 in.) above the container bottom. _____
15. Stopwatch capable of measuring to at least the nearest 0.1 s. _____
16. Meter stick capable of measuring to nearest 1 mm (0.5 in.). _____
17. Caliper capable of measuring to nearest 0.1 mm (0.01 in.). _____
18. Sealing agent (petroleum jelly) and spatula. _____
19. Saw for wet cutting specimens to desired thickness (optional). _____